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An Initial Exploration of Stakeholder Benefit Dependencies in Ambulatory E-Prescribing

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ABSTRACT

Ambulatory e-prescribing appears to be a straightforward automation effort that electronically connects a prescriber to an electronic network so an e-script can be sent to a pharmacy. A benefits dependency network (BDN) traces the path from an IS/IT enabler, an e-prescribing module, that enables a business change which results in a benefit. A BDN is particularly useful in e-prescribing which functions as an inter-organizational system. The greatest benefits don't accrue to stakeholders - the individuals in the medical practices and pharmacies who are the stakeholders being asked to invest in the technology. The initial BDN shows that reduced adverse drug events, the greatest expected outcome of e-prescribing, is dependent upon the least mature of the e-prescribing modules.

Keywords

E-prescribing, stakeholder analysis, benefits management, inter-organizational systems, e-health, healthcare information system

INTRODUCTION

The concept of ambulatory e-prescribing, automation of the handwritten prescription and delivered electronically, appears to be a win-win healthcare technology in the ambulatory setting. Economic benefits of e-prescribing are attributed to eliminating illegible handwriting, reducing hundreds of millions of calls annually that are exchanged between healthcare providers and pharmacies, and greater formulary adherence that reduces the cost of prescription drugs (MA-SHARE MedsInfo ED, 2006; Pennell, 2005). The clinical benefits are the prevention of adverse drug events through enabling of clinical decision support on e-prescribing tools. These benefits have been widely touted in numerous reports (Teich et al., 2004; Sarasohn-Kahn and Holt, 2006; Moiduddin et al., 2007).

Governments at the state and national level of the United States have passed legislation supporting e-prescribing. Payers such as insurance companies have invested in numerous pilot projects (e.g., (Angell, 2006)). Efforts are underway to convince prescribers to invest in e-prescribing despite a payback on investment that could take several years for small practices (The eHealth Initiative, 2008). So why would any stakeholder not want to adopt e-prescribing? Despite repeated calls to stop writing prescriptions by hand since at least 1998 (Schiff and Rucker, 1998; Kohn et al., 1999), only 35,000 (six percent) of office-based physicians are e-prescribing today according to transaction data collected by the Pharmacy Health Information Exchange (PHIN) (Surescripts, 2007a). Just 2% of these eligible prescriptions were sent electronically in 2007 which includes faxing. Given the low rates of adoption, there must be barriers that have not been accounted for.

This paper explores in a descriptive manner the linkage between e-prescribing functionality, expected outcomes, and the benefits or dis-benefits to the stakeholders investing in e-prescribing technologies. A broad set of literature is used to map benefits and costs to each set of stakeholders using a benefits management framework. This mapping intends to show that e-prescribing has characteristics of an inter-organizational information system which makes explicit inter-relationships and dependencies. This in turn sets the stage for future research that explores which incentives are likely to encourage e-prescribing adoption in which benefits or costs may not accrue equally.

BACKGROUND

E-prescribing is portrayed as a technology that electronically connects a prescriber to an electronic network so an e-script, rather than a handwritten prescription, can be sent to a pharmacist. The prescribers must adopt e-prescribing technology to input and send an e-script. Pharmacies need to upgrade their software to receive an e-script. Technological intermediaries, such as the PHIN, are needed to deliver the e-script as well as process formulary verification requests with payers. This automation then steers e-scripts toward lower cost alternatives and reduces medication errors through a drug warning feature.

The prescriber, usually a physician, electronically inputs the prescription information. The prescriber then checks the selected medication with the formulary connected electronically to the payer that covers a particular patient. The prescriber

may also be given automated alerts that check for drug-drug or drug-allergy interactions. After obtaining from the patient the contact information for the preferred dispenser (i.e., pharmacies of all types including mail-order), the e-script is sent electronically through an e-prescribing network. The dispensing location receives the e-script through the software that is used to adjudicate the claim with a pharmacy benefit manager (PBM) or payer. If there are problems with the claim, the pharmacist contacts the prescriber electronically rather than playing “phone tag”.

Key to the adoption of e-prescribing is an understanding of stakeholder interests and the benefits that accrue to them. There are half a million physicians and over 230,000 pharmacists, many in independently owned practices or pharmacies. For example, physicians are generally in favor of the clinical benefits of e-prescribing, but see its adoption as a low priority primarily due to administrative, implementation and financial costs (Grossman et al., 2007). Similarly, receiving a clean prescription generated by e-prescribing should reduce third party problems which is a major complaint of pharmacies (Schering, 2007). However the cost to receive each and every e-script can be as high as one dollar which can easily add five per cent to the cost of dispensing a prescription for small independent pharmacies. In this situation, the stakeholders is the pharmacy owner who wants to know if any savings will be realized for them.

Adoption of business systems on a similar scale have been stymied for many reasons including lack of consideration of stakeholders. The web of stakeholders in electronic payment systems stymies such a system when there is an inequitable distribution of risks and costs and insufficient critical mass (Choudrie et al., 2003). The analysis introduced in this paper is a first step at identifying the distribution of risks and costs among e-prescribing stakeholders.

FRAMEWORK

Advocates of e-prescribing emphasize the collective benefits that are realized if individual members of stakeholder groups would participate. Yet these individuals, many in single physician practices or independently owned pharmacies, must make an investment decision as a small business owner. Adoption decisions in inter-organizational settings must consider readiness, perceived benefits, and external pressure (Chwelos et al., 2001). Normative pressure to adopt is only effective when the majority of the network is participating (O'Donnell and Glassberg, 2005). Otherwise early adopters will likely act based on the potential for benefits rather than altruistic reasons. Other stakeholder groups are the software developers for both practices and pharmacies, payers, and the e-prescribing infrastructure providers such as RxHub's National Patient Health Information Network (prescriber to payer) and Surescripts' Pharmacy Health Information Exchange (prescriber to pharmacy). Each stakeholder group participates for different reasons with different process change implications and most important – which benefits are received.

Missing from the e-prescribing advocacy literature (Institute for Safe Medication Practices, 2000; Aspden et al., 2006; The eHealth Initiative, 2008) is an explicit recognition of the inter-dependencies between stakeholders and imbalance of accrued benefits. This literature does identify stakeholders such as practices and their prescribers, pharmacies and their pharmacists, payers, and patients, but not as a network of individuals within these stakeholder groups who ultimately must adopt the technology. The eHealth Initiative (2008, p. 4) alludes to this concern: “Prescribers ... may believe they bear more than their fair share of the cost of e-prescribing, since other stakeholders also benefit from the savings” but goes on to emphasize the broader cost savings and quality improvements that may be realized. For the individual medical practices and pharmacies who must make a significant monetary and resource investment, altruism goes only so far.

Inter-organizational Systems

E-prescribing is a hybrid inter-organizational system (IOS) because the actual transaction is characteristic of an electronic data interchange (EDI) but the matching of a prescriber and pharmacy is typical of a web-based marketplace. Current IOS are either a web-based marketplace or in an EDI relationship (O'Donnell and Glassberg, 2005). E-prescribing relies upon a multitude of decentralized and autonomous practices and pharmacies inter-connected to several centralized infrastructures (NPHIN and PHIE). Coordination in an IOS needs the alignment of multiple perspectives (Ponisio et al., 2007). Given the autonomy of participating business owners, an effective IOS needs a high level of consent and cooperation (Williams, 1997). Cooperation comes from incentives to participate – namely an equitable share of benefits for the effort and resources invested.

Benefits Dependency Network

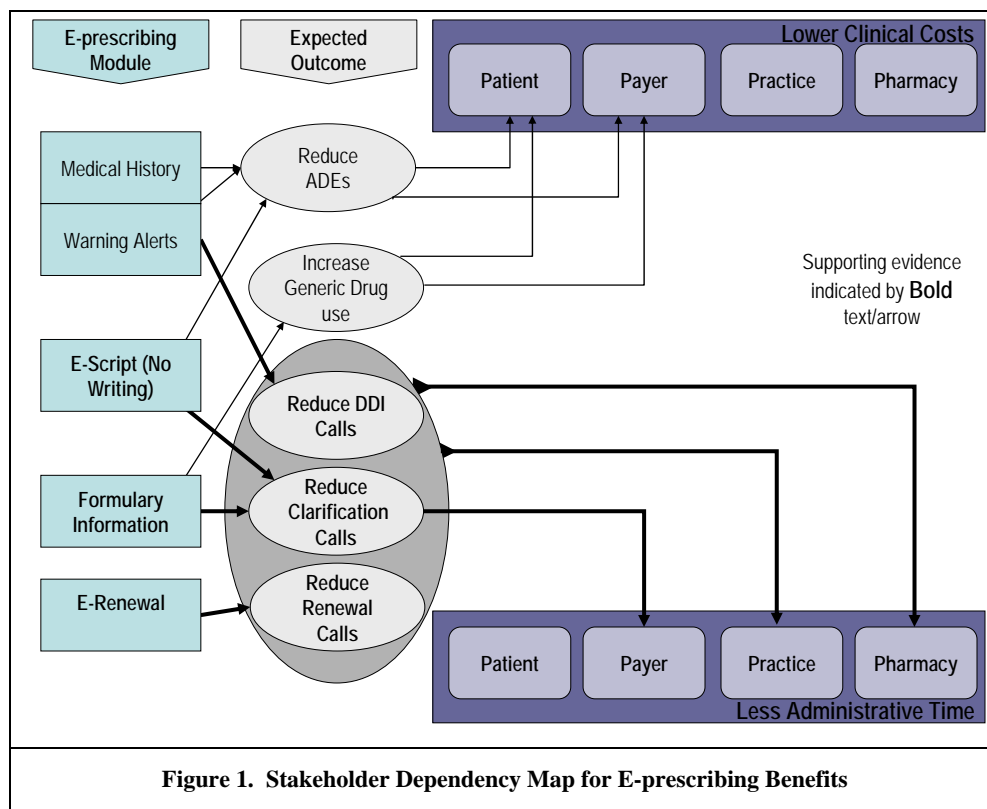
For most businesses considering the adoption of e-prescribing, generating benefits is the only valid reason for investing in change. Without generating benefits for at least one group of stakeholders, there is no good reason for investing in change (Bradley, 2006). Understanding where benefits may be of value to the organization making the investment is crucial to determine if its staff, patients, the national healthcare system, or less likely, the payers may benefit. A benefit is the value

placed by a stakeholder on the improvement or new capability resulting from an outcome. Benefits are identified by asking stakeholders to state how they believe they will experience the value of the outcome (Integrated Service Improvement Programme, 2008).

The benefits dependency network (BDN) for e-prescribing maps the outcome attributed to the introduction of an e-prescribing module to the stakeholders who benefit from such an outcome. Using BRM/BM terms (Ward and Daniel, 2006), the e-prescribing modules are IS/IT enablers that enable changes resulting in a business change which we call an outcome. These changes lead to benefits that can be mapped to a stakeholder. For example, there is evidence that electronically generated e-scripts reduce clarification calls resulting from poor handwriting. Fewer calls results in an administrative savings to the pharmacy and prescriber's practice for calls that are avoided. Our study uses evidence from the literature to support claims that a particular e-prescribing module leads to the expected outcome. In addition, literature is used to verify that an outcome actually leads to a benefit or just shifts the task or costs to another party. Most e-prescribing literature describes only the benefits that accrue to their stakeholders rather than a more holistic view attempted in this paper.

METHODOLOGY

A three step benefits dependency framework is used to trace an e-prescribing module to a claimed outcome and in turn any benefit that may result from the module adoption. The identification and assessment of the linkages from module to business benefits results in a stakeholder BDN diagram (Figure 1). The leftmost column contains e-prescribing modules. The second column represents the outcome expected to result from adopting the module. Finally, the benefits from these outcomes are traced to various stakeholders on the right of the figure. Benefits are classified as lower clinical costs or less administrative time.



The first step for this framework requires identifying a comprehensive list of claimed e-prescribing benefits (e.g., (MA-SHARE MedsInfo ED, 2006; Pennell, 2005)). The next step extracts from a broad set of literature those findings that support (or rebut) the claimed outcomes and the linkage of benefits to a stakeholder group (e.g. prescribers). The collection of articles to assess these linkages currently includes a working set of 158 references. The set of literature examined is much larger, nearly 500 entries deemed of sufficient value to enter in a citation manager database (e.g., Endnote). The literature is drawn from the fields of medicine (physician and general healthcare), pharmaceuticals (including pharmacy and medication errors),

medical informatics, and related topics that did not fit such as consumer health surveys. Over half are from academic journals as shown in Table 1.

	Medicine	Pharmaceutical	Informatics	Other Topics	Total
Academic Article	11	42	30	0	87
Government Report	5	2	3	0	10
Trade Association Report	8	19	6	2	35
Magazine or Newspaper	8	3	8	7	26
Total	32	66	47	13	158

Table 1. Breakdown of Data Sources

The claimed outcomes and benefits are assessed based on the literature that addresses the topic. There have been few academic studies to date on specific features of e-prescribing which limits the ability to use meta-analysis. Figure 1 uses bold text and bold arrows to show when a module, outcome, benefit and the connecting linkage is supported by the literature. This assessment includes technological readiness. For example, a sophisticated drug and warning alert system probably reduces adverse drug. However, the technology is either not deployed by software providers or performs poorly so this e-prescribing module is labeled in plain font. Drug-drug interactions (DDI) intercepted at the point of prescribing and corrected will of course reduce “DDI calls” from the pharmacist who usually catches these errors and the linkage is shown in bold indicating support for the claim. However, the link to “Reduce ADE” remains un-bolded because of a lack of evidence.

SUMMARY OF ANALYSIS

The analysis completed to date is summarized in this section using selected references to illustrate key points. Five e-prescribing modules account for the bulk of the claimed outcomes and resulting benefits. These modules are listed in order of increasing difficulty to develop and implement. The e-script module requires the prescriber to input patient and prescription information so that an e-script can be sent electronically via the PHIE. The e-renewal module allows pharmacies to electronically request a new prescription when the number of prescribed refills has been reached. The formulary information module connects the prescriber with payer formulary information via the NPHIN. The prescriber can then make changes in the prescription to reflect payer policies (e.g., generic substitution). The medical history module connects the e-script module to the medical records of the patient so that the prescriber has a complete patient history before prescribing. The warning alerts module compares the prescription with other medications that have been ordered and the condition of the patient to determine if a drug interaction is possible.

E- Script

The basic e-script module is expected to reduce clarification calls and reduce adverse drug events (ADE) that have occurred in past due to illegible handwriting. Illegible handwriting leads to misinterpretation by pharmacies or time-consuming clarification calls. E-script modules have been certified for 80% of software providers at the end of 2007 (SureScripts, 2007b). Use of an e-script module reduces some illegibility problems (Southeast Michigan e-Prescribing Initiative (SEMI), 2005). Unfortunately e-script modules introduce other errors which e-prescribing advocates fail to mention (Horsky et al., 2005). Overall, the e-prescribing module is a reality and being deployed thereby represented in bold text (i.e., supporting evidence) on Figure 1.

Payers and patients will have lower clinical costs if the numbers of ADE are reduced due to the elimination of the handwriting illegibility. Even though illegibility is recognized as a problem (e.g., (Schering, 2007)) and can be eliminated, there is still limited evidence to whether an e-script actually lowers the number of ADEs (Fischer, 2007). Consequently, neither the linkage between E-script and reducing ADE’s nor the linkage between reducing ADE’s and the Payer and Patient as stakeholders can be confirmed (i.e. non-bold).

Reduction of clarification calls to prescribers because of illegibility have been reduced (Southeast Michigan e-Prescribing Initiative (SEMI), 2005), although the literature generally does not distinguish the source of reduced callbacks in e-prescribing pilot studies. This is the reason Figure 1 treats all the reduced call outcomes collectively except for reduced

clarification calls. This outcome is achievable and leads to lower administrative costs for both practices and pharmacies. The linkage and outcome “Reduce Clarification Calls” are supported.

The path from the “reduce clarification call” outcome to the practice and pharmacy are also supported. These businesses are the ones who invest in the e-prescribing software and gain some benefit in reduced clarification calls. An important distinction is that the prescriber (individual) and the practice (business) are impacted differently. The benefit accrues to the practice rather than the prescriber who may actually spend more time inputting an e-script than just writing or typing a prescription.

E-Renewals

The potential impact of e-renewals on a practice stems from eliminating the need to pull patient charts and assign staff to renewal calls. Renewals account for nearly half of current call volume (Ennis and Maus, 2001). Another claimed benefit is speeding the prescription renewal process (MA-SHARE MedsInfo ED, 2006). The latter benefit presumes that the prescriber processes renewals throughout the day via the software rather than the current practice of getting back to pharmacists before lunch and closing time.

Pilot studies show significant reductions in callback due to an e-renewal module. Two-thirds of software providers include this feature (SureScripts, 2007b). The dependency relationship benefits of e-renewal have supporting evidence of reduced callbacks. Whether the patient sees a reduction in waiting time (as claimed) is unclear. E-renewal turns a synchronous process (call) into an asynchronous one (message).

The inter-dependencies among IOS stakeholders are evident in the use of this module. Prescribers only benefit from e-renewals if pharmacies have upgraded to an integrated e-prescribing module. Otherwise the traditional callback is used. A critical mass of networked users are necessary, prescribers and their patient’s pharmacies, for widespread adoption to take place. A Catch-22 since pharmacies are reluctant to upgrade if the prescribers they work with do not use e-prescribing.

Formulary Information

Another potential incentive to adopt e-prescribing is related to formulary management. The formulary and benefits standard is intended to supply prescribers with information about a patient’s drug coverage at the point of prescribing. The aim is to enable the prescriber to take this information into account at the time of prescribing which reduces the amount of back-and-forth communication needed with the pharmacy or the health plan (Moiduddin et al., 2007). There is also an expected increase in the use of generics and preferred drugs resulting in savings for both the patient and insurer (Cox et al., 2005; Pennell, 2005). Two expected outcomes of this module are: more generic drug use and reduced calls.

While formulary information should have a direct impact on drug costs and generic use due to formulary adherence, the evidence is unclear (Ross et al., 2005). While there is progress implementing the “Formulary Information” module, prescribers are reluctant to use this feature without assurances that the formulary information is actually available (Moiduddin et al., 2007). While the early evidence suggests the outcome “Increase Generic Drug Use” is likely if the formulary information is available, the results are mixed so unsupported. In addition, patients may resist using generics if the co-pay for a brand drug is not that much different (Mager and Cox, 2007). There is definitely a benefit to both the payer and the patient if generic usage increases so the linkage between “Increase Generic Drug Use” and the stakeholders will be shown as supported (e.g., bold arrows) in the future.

The formulary information module illustrates the IOS challenge of e-prescribing. The prescriber does all the work to look up alternative drugs on the formulary and convince the patient to use them. The payer, and to a lesser degree the patient, pockets the majority of the resulting savings. If the prescriber has checked the formulary, there is a reduction in formulary clarification calls from the pharmacist who finds fewer incidents requiring a callback. The practice asks themselves is there sufficient payback with the extra work done by their prescribers.

Access to Patient’s Medical History

Supporters of e-prescribing believe that access to a patient’s medical history can help clarify several issues, such as drug allergies and drug-drug interactions. This in turn reduces ADEs which is one of the most anticipated outcomes of e-prescribing (Institute for Safe Medication Practices, 2000). E-prescribing can also identify patients who are not in compliance with the medications ordered (Bieszk et al., 2003).

The reality is missing prescription information (Smith et al., 2005). While medical histories are generally more complete with electronic patient records (Smith et al., 2005), an electronic patient record (EPR) forces even more far-reaching process

change to a medical practice and the corresponding investment that is required. Further research is needed to determine better ways for displaying and maintaining up-to-date medication histories to providers (Moiduddin et al., 2007). Consequently the connector between “Medical History” and “Reduce ADEs” is not supported. Moreover the connector between “Reduce ADEs” with the patient and payer cannot be supported because the relationship with lower clinical costs has not been verified.

Warning Alerts

The system of warning alerts to detect drug-drug or drug-allergy interactions at the point of prescribing represents one of the best opportunities to improve the quality of patient care. Early results show a range of improvements. Over 2% of e-scripts have been changed due to warning alerts in one pilot (Leahy, 2007) and nearly 15% of e-scripts were changed during a trial at the Henry Ford Health Clinic (Chin, 2006). Clinicians and pharmacists believe that computerized decision support (alert module) can improve safe drug prescribing but more work is needed to increase their clinical utility (Ko et al., 2007). More than 90% of alerts are currently ignored (van der Sijs et al., 2006; Weingart et al., 2003).

Assuming that a comprehensive medical history is available at the time of prescribing, this will lead to a more effective use of the warning alert system. Drug alerts are currently ignored because they are not specific to a patient and fail to account for other clinical conditions (Indermitte et al., 2007; Gaikwad et al., 2007). There is still limited clinical utility with the current generation of warning alerts (Abarca et al., 2006; AHRQ, 2007). As a consequence, the warning alert module is left in plain font as well as the linkage to reduced ADEs. Similarly, reduced ADEs is left in plain font as well as the linkage to the respective stakeholders, payers and patients.

An effective drug warning alert module requires access to a medical history (drugs taken and tolerance to them), adverse event database (new drug-drug interactions), a patient’s medication history, and prescribers willing to put up with high error rates. Aligning all these sources of information to allow a prescriber to take on a role traditionally done by a pharmacist presents challenges extending beyond the technology itself.

CONCLUSION

Ambulatory e-prescribing, at first glance, appears to be a straightforward automation effort that electronically connects a prescriber to an electronic network so an e-script can be sent to a pharmacy. The reality is much more complex. With respect to implementation alone, e-prescribing requires the concurrent adoption by multiple and often competing stakeholders whose interests are often at odds with each other. Within each stakeholder group, such as pharmacies, there are a large number of competitors within a few miles of each other. Coercion by a powerful trading partner (Morris et al., 2003), such as the 2009/10 e-prescribing incentive and future penalties mandated by the Centers for Medicare & Medicaid Services (CMS), should result in increased adoption. Whether this is sufficient to reach a critical mass depends on the degree that individual adopters look at the benefits and cost impact to them. The inter-organizational nature of e-prescribing means that the individual practices and pharmacies involved in an e-script transaction due so at the behest of other organizations (e.g., payers) utilizing the support of centralized networks run by other organizations.

The stakeholder benefits dependency network (BDN) traces the source of these benefits so that informed investment decisions can be made by individual adopters. The BDN shows at a glance that the most critical clinical benefit driving e-prescribing, reduced ADEs, depends on the least developed e-prescribing modules of medication history and warning alerts. Most of the economic benefit attributed to e-prescribing comes in the reduction of clinical costs associated with treating ADEs. There are lesser administrative benefits that accrue to stakeholders from the adoption of e-prescribing. However, this early analysis suggests that the benefits may not accrue to the stakeholders as originally expected. For example, the practices may receive fewer clarification calls but this is partly because they must take on more of the tasks that have been done at the pharmacy (e.g. third party eligibility). Further analysis of the literature using a stakeholder BDN network may find additional insights crucial to the considerations taken by individuals in these stakeholder groups. The paper contributes to the research and practice of e-prescribing by showing how existing models in the IS literature bring fresh insights. There are likely other models that can contribute to a greater understanding of e-prescribing so adoption can be accelerated.

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